Examining the effects of implicit and internalized weight bias on physical activity participation for women in larger bodies

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Abstract

The present study uses the term "people in larger bodies" in an effort to shift research terminology away from weight-normative labels like "overweight or obese" which further perpetuate the pathologization of larger bodies (Decker et al., 2018).

Weight stigma represents discrimination associated with the social beliefs that people in larger bodies have low willpower, are unmotivated, and are personally responsible for their elevated weight. Internalized weight stigma is the extent to which social perceptions of weight stigma are attributed to the self by people in larger bodies. Dual process models may be uniquely situated to help us understand how weight stigma becomes internalized and whether this impacts (physical activity) PA participation. Within dual process models two systems regulate how we think; the associative system reflects automatic associations and feelings, whereas the propositional system represents deliberate and controlled reasoning. Past research has examined social perceptions of explicit weight stigma alongside implicit measures, rather than examining the internalized form of weight bias. The purpose of this study was to examine whether implicit weight bias (an associative process) and internalized weight bias (a propositional process) are significantly associated with the expectation of experiencing weight stigma, self-regulatory efficacy, the tendency to avoid PA, PA intention, and PA. All eligible participants (n = 154) were over 18, self identified as a woman, had a BMI over 25 and self-identified as a person living in a larger body. Implicit weight bias was measured using a single category Implicit Association Test, while the other study variables were measured using validated survey measures. We conducted a series of hierarchical multiple regression analysis, entering covariates in step 1, implicit weight bias in step 2, and internalized weight bias in step 3. In step 3, both implicit and internalized weight bias were significantly associated with self-regulatory efficacy ($p < .001$, $r^2 = .183$) and light past PA ($p < .05$, $r^2 = .065$). Contrarily, the expectation of experiencing weight stigma ($p < .05$, $r^2 = .120$) and the tendency to avoid PA ($p < .001$, $r^2 = .297$) were both significantly

associated with implicit weight bias in step 2. However, once internalised weight bias was added into the equation in step 3, the implicit association became not significant. No relationship was observed between PA intention, implicit weight bias and internalized weight bias. Similarly, there was no relationship observed between moderate to vigorous physical activity, implicit weight bias and internalized weight bias ($p > .05$). Implicit weight bias and explicitly measured internalized weight bias were associated with psychological cognitions that may deter PA. They seemed to be more strongly related to cognitions than behaviours, which might suggest that they have indirect relationships with PA. Examining both implicit and internalized weight bias together, through a dual process lens provided insight into the nuanced relationship that people in larger bodies have with PA participation. Future health promotion strategies should consider these findings and must work to shift away from their weight centric approach that may exacerbate internalized weight bias and instead, adopt a more weight-neutral approach towards PA participation.

Key words: PA, weight stigma, dual processing, exercise psychology, health promotion

Positionality Statement

My own experiences have without a doubt shaped my view of the world, and therefore this positionality statement is an attempt to inform the reader of the research lens that was used to conduct this study. I am an educated, queer, South Asian woman, who also happens to live in a larger body. I was born in India and immigrated to Ontario, Canada at the age of 11. Prior to my undergraduate and master's degree at Brock University, I received a diploma in Fitness and Health Promotion from Seneca College. During my college education, I noticed the curriculum perpetuated anti-fat biases and idealized smaller bodies. As the only woman of color and the only woman in a larger body in my program, I felt excluded. My peers believed that people in larger bodies needed to lose weight to be considered "healthy," reflecting a historical pattern of racism and ableism. This study design has been influenced by my own positionality and lived experiences as someone with a health promotion background, as a queer, south Asian woman, and as a fat woman. As someone with lived experience, I have an insider's perspective of the barriers experienced by people in larger bodies, especially when it comes to participating in PA. My lived experiences have also shaped me into an advocate for people in larger bodies and this research is an effort to deconstruct weight bias and examine it as a barrier for people in larger bodies. All study participants were recruited through an online recruitment platform and filled out an online questionnaire and completed a single category implicit association task. The study participants had minimal interaction with the research team and all results were analyzed by the main author.

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List of Abbreviations

PA	Physical Activity
ART	Affective Reflective Theory
SRE	Self-Regulatory Efficacy
OE	Outcome Expectation
Internalized WB	Internalized Weight Bias
Implicit WB	Implicit Weight Bias
SCT	Social Cognitive Theory
IAT	Implicit Association Task
MVPA	Moderate to Vigorous Physical Activity
WBIS	Weight Bias Internalization Scale
TAPA	Tendency to Avoid Physical Activity
FAES	Fear of Appearance Evaluation Scale

Introduction

The present study uses the term “people in larger bodies” in an effort to shift research terminology away from weight-normative labels like “overweight” or “obese” which further perpetuate the pathologization of larger bodies (Decker et al., 2018).

Weight Stigma

Weight stigma is the devaluation, discrimination and stereotyping that is experienced by people living in larger bodies (Nutter et al., 2023; Decker et al., 2018). Weight stigma stems from common social beliefs that people in larger bodies have low willpower, are lazy, unmotivated, and personally responsible for their elevated weight (Nutter et al., 2023; Decker et al., 2018). Traditional “obesity prevention” messages focus solely on encouraging individuals to eat less and move more, which adds unwarranted blame on the individual and disregards the many interconnected biological, psychological, and environmental determinants of health that influence body shape and size (Nutter et al., 2023). Making health behavior changes often results in only small changes in body weight. Yet, health promotion messages primarily focus on weight loss, and further perpetuate Western thin ideals, that continue to stigmatize people in larger bodies.

Individuals in larger bodies are 50-60% more likely to experience major discrimination as a result of their weight status (Nutter et al., 2023; Durso & Latner, 2008). The World Obesity Federation’s position statement outlines weight stigma as an important social determinant of health (Nutter et al., 2023). Weight-based discrimination has been positively associated with disordered eating, depression and anxiety, suicidality, substance use, body image concerns, and negatively associated with self-esteem (Nutter et al., 2023; Durso & Latner, 2008).

Experiences of weight stigmatization are more common among women, as research has indicated that women are more likely to be exposed to stigmatizing situations across interpersonal, institutional, and societal domains (Forbes & Donovan, 2019). According to previous research, women have also reported significantly higher levels of weight stigma and internalized weight bias when compared to men (Bevan et al., 2021). Additionally, individuals experiencing weight stigma have been found to limit their participation in social and leisure activities and tend to isolate themselves in order to cope with the impact of the stigma (Forbes & Donovan, 2019). Aside from poorer social outcomes, experiences of weight stigma are also associated with decreased motivation to exercise and lower overall physical activity (PA) levels (Nutter et al., 2023; Meadows & Bomback, 2019). But what happens when these negative societal stereotypes about weight are internalised and attributed to the self?

Research suggests that people in larger bodies not only experience weight stigma, but can also internalise it, endorsing the negative weight-based stereotypes and attributing those negative attitudes to themselves (Nutter et al., 2023; Durso & Latner, 2008). Higher levels of internalized weight bias have been associated with lower enjoyment of PA, and greater tendency to avoid PA and sport participation (Bevan et al., 2021). Previous research has examined internalized weight bias and how it impacts psychological (i.e., self-efficacy) and behavioural outcomes (i.e., PA/ exercise) (Gumble & Carels, 2012; Bevan et al., 2021). However, to our knowledge, none of these studies have used a dual process approach to examine both implicit weight bias and explicit markers of internalized weight bias.

Broadly, dual process models (e.g., Gawronski & Bodenhausen, 2011) suggest that biases or stigmatizing perceptions can occur both implicitly and explicitly. From this perspective, weight bias can be internalized at the implicit and explicit level. Explicit anti-fat attitudes are

self-reported attitudes of which individuals are consciously aware. In contrast, individuals may also possess implicit anti-fat attitudes, which are conceptualized to be outside of individuals' awareness and conscious control (Gumble & Carels, 2012). When examining internalized weight bias, a dual process approach is necessary, as social cognitive theory considers cognitive processes as strictly explicit and fails to explicitly include implicit processes that influence PA. Both implicit and explicit anti-fat biases have the potential to make PA participation more difficult for people in larger bodies (Pearl et al., 2015). This study aimed to examine the relationship between internalized weight bias and PA-related thoughts and behaviour through a dual process perspective.

Dual Process Models & Affective Reflective Theory (ART)

Human behaviour is thought to be regulated by two different types of mental processes that operate in parallel to regulate our feelings, decisions, and actions: propositional and associative (Brand & Ekkekakis, 2018). The propositional system reflects explicit evaluations and includes controlled reasoning, whereas the associative system reflects implicit evaluations and reflects instinctively learned associations and feelings.

The propositional system consists of effortful processes that an individual is consciously aware and in control of, enacting behaviour based on conscious deliberation. The propositional process requires cognitive capacity to make complex decisions (Presseau et al., 2014) and is exemplified by social-cognitive theories that evoke constructs such as intentions, efficacy beliefs, and outcome expectations. On the contrary, the associative system consists of processes that occur rapidly and effortlessly, as they do not require conscious processing or elaboration. As a result, associative processes become the default in determining behaviour, unless there is a need and conscious capacity for decision making (Presseau et al., 2014). Both of these processes are

thought to be the upstream determinants of affectively charged motivation for PA and other health behaviors (Conroy & Berry, 2017). Even though social cognitive theories that reflect propositional processes have dominated exercise psychology (Conner & Norman, 2015), there is increasing recognition that associative processes also impact motivational aspects of PA engagement (Conroy & Berry, 2017). Examining both associative and propositional systems is important in understanding how our thoughts translate into behaviour.

The Associative-Propositional Evaluative (APE) Model is a dual process framework that provides clear operational definitions about how associative and propositional processes function and interact. Associative processes activate mental associations in memory, which are driven by the contiguity between the original stimuli and the available memory representations of said stimuli. It should be noted that associations can be activated in memory regardless of the accuracy of the presented information. Additionally, the associations that are activated in response to a presented stimulus depend on the pre-existing structures of associations that are present in both the memory and the overall set of input stimuli (Conroy & Berry, 2017).

Once mental associations are activated, propositional processes are concerned with the accuracy and validity of the activated associations. The consistency of that information between propositional beliefs is a central determinant of whether the information implied by activated associations is accepted in the process of propositional validation. Propositional processes translate affective gut responses about the presented stimuli, which are then turned into propositional statements (Gawronski & Bodenhausen, 2011). For example, a negative affective gut reaction toward people in larger bodies, may be transformed into propositional statements such as “I dislike fat people”. The resulting propositional statement should be consistent with other, propositional beliefs that are relevant for making an evaluative judgment, such as the

belief that fat people are lazy or that fat people are unhealthy. However, if the propositional evaluation implied by the affective gut response is inconsistent with other salient propositions that are considered relevant, the inconsistency must be resolved to avoid aversive feelings of cognitive dissonance (Gawronski & Bodenhausen, 2011).

Affective Reflective Theory (ART; Brand & Ekkekakis, 2018) was developed specifically to understand PA. While it borrows conceptual definitions from APE, it also focuses on affective responses to PA and how these affective responses encourage or discourage PA. As stated by ART, past experiences with PA can elicit core affective feelings, where a past negative experience can automatically re-actualize in moments when the individual is presented with an exercise-related stimulus (Brand & Ekkekakis, 2021). ART focuses on the moment when an exercise-related perception occurs. External stimuli (e. g., hearing a doctor's advice to start exercising) and internal stimuli (e. g., remembering the doctor's advice to exercise) trigger automatic associations related to the object of evaluation (i.e., exercise-related stimuli). The individual's automatic affective response and the connected action impulse result in the individual either changing their state (taking action) or actively restraining from changing their current state. The resulting response is an action impulse that can either be approach-oriented or avoidance-oriented towards exercise. The deciding factor is the availability of self-control resources and determining whether the predominant influence on behavior is associative or propositional processing. Individuals will remain in a state of physical inactivity if the core affective valence associated with the current state of physical inactivity is more positive than the affective valence associated with exercise, particularly when self-control resources are low.

In the current context, when people in larger bodies are cued to think about exercise, they may have an automatic negative affective reaction to exercising, which then forms the basis of

the propositional process from which an explicit evaluation develops (Brand & Ekkekakis, 2018). Figure 1a, 1b, and 1c depict the process of validating inconsistent propositional evaluations using the example of a person in a larger body experiencing a negative affective reaction towards thinking about exercise. Propositional processing translates a subjective affective reaction (e. g., a negative affective reaction to exercising, particularly in public settings) into a propositional statement (i.e., propositional statement 1; "I'm fat and don't belong at the gym"), which can then be related to other stored and relevant propositional beliefs, (i.e., propositional statement 2; "I expect to get teased because I have seen other fat people get teased for being at the gym" and propositional statement 3; "I'm not confident that I can go to the gym") (Figure 1a) which will then determine the explicit evaluation. The propositional evaluations implied by the affective gut response are used to form an approach or avoidance-based judgement if these propositional evaluations are consistent with each other (e.g., approach or avoid exercise).

When the propositional evaluation implied by the affective gut response is inconsistent with other relevant propositional beliefs, the inconsistency will have to be resolved to avoid aversive feelings resulting from cognitive dissonance. Propositional statements that are inconsistent with each other cannot be endorsed at the same time. For example, if the individual were to reject propositional statement 3 ("I am confident that I can go to the gym" to "I am not confident that I can go to the gym") (figure 1b) this would result in the model being consistent and fully accepting the negativity of the original affective gut response, resulting in an action impulse that avoids PA. However, if consistency is achieved through the rejection of Propositional statement 2 ("I expect to get teased because I have seen other fat people get teased for being at the gym") (figure 1c), the individual may reject the original negative affective

reaction and endorse a more neutral or positive evaluation ("I will probably be accepted at my gym") (Gawronski & Bodenhausen, 2011). This results in a connected action impulse, that approaches PA (figure 1c).

It should be noted that the rejection of Propositional statement 1 may lead to a dissociation between implicit and explicit evaluations, such that implicit evaluations may still reflect the negativity of the affective gut response (i.e., implicit weight bias beliefs from propositional statement 1), but explicit evaluations may reflect the neutral or positive evaluation that is inferred in the propositional validation process (Gawronski & Bodenhausen, 2011). This may create cognitive dissonance which is resolved through the rejection of a previously endorsed explicit evaluation. Importantly, it should be noted that the propositional process involved in rejecting the proposition implied by the affective gut response in one particular situation does not necessarily permanently deactivate or eliminate the automatic association that gave rise to it in the first place (Brand & Ekkekakis, 2018). Implicit processes are driven by spatiotemporal contiguity between a stimuli and the similarity between the features of input stimuli and available memory representations which are activated through contextual clues (Gawronski and Bodenhausen, 2011).

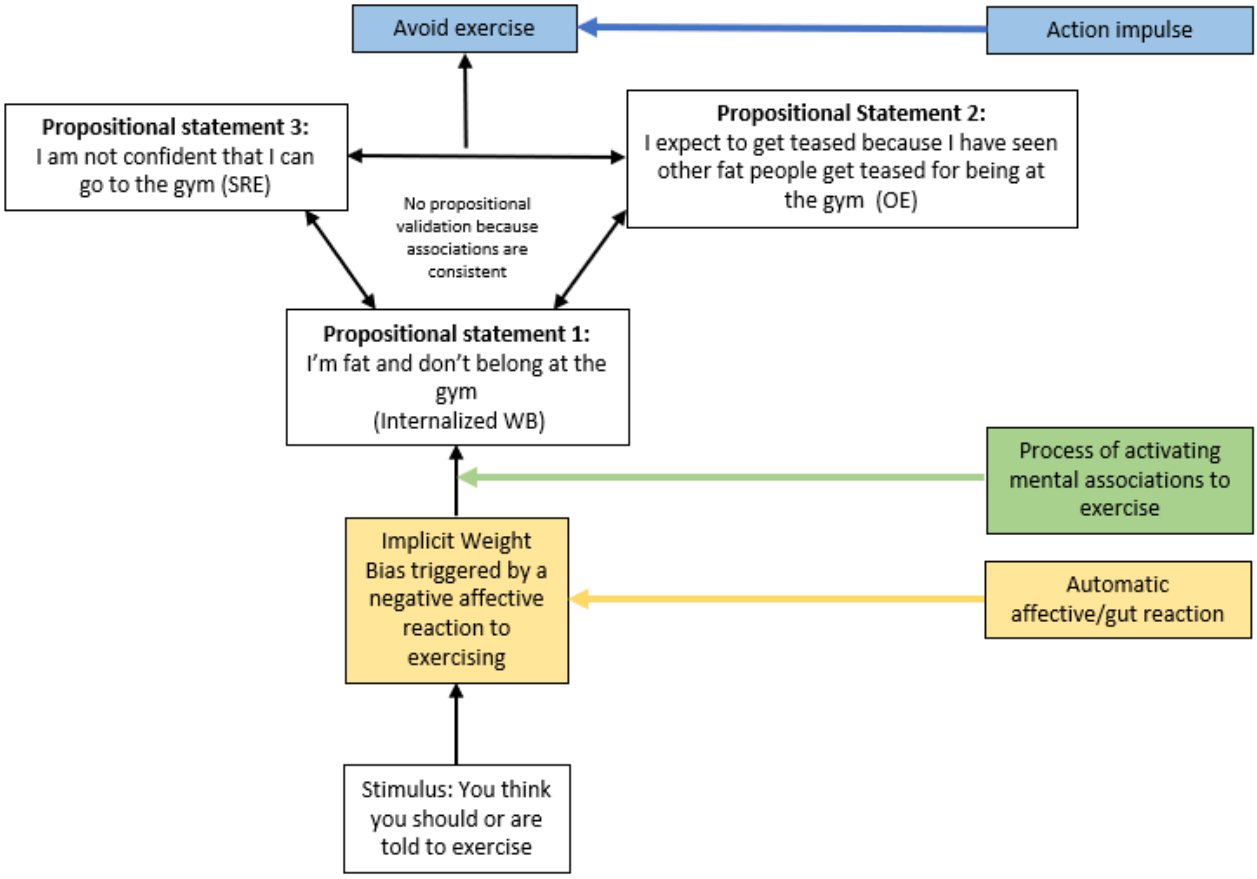
Avoid exercise
Action impulse
Propositional statement 3:
I am not confident that I can go to the gym (SRE)
Propositional Statement 2:
I expect to get teased because I have seen other fat people get teased for being at the gym (OE)
No propositional validation because associations are consistent
Propositional statement 1:
I'm fat and don't belong at the gym
(Internalized WB)
Process of activating mental associations to exercise
Implicit Weight Bias triggered by a negative affective reaction to exercising
Automatic affective/gut reaction
Stimulus: You think you should or are told to exercise

Figure 1a

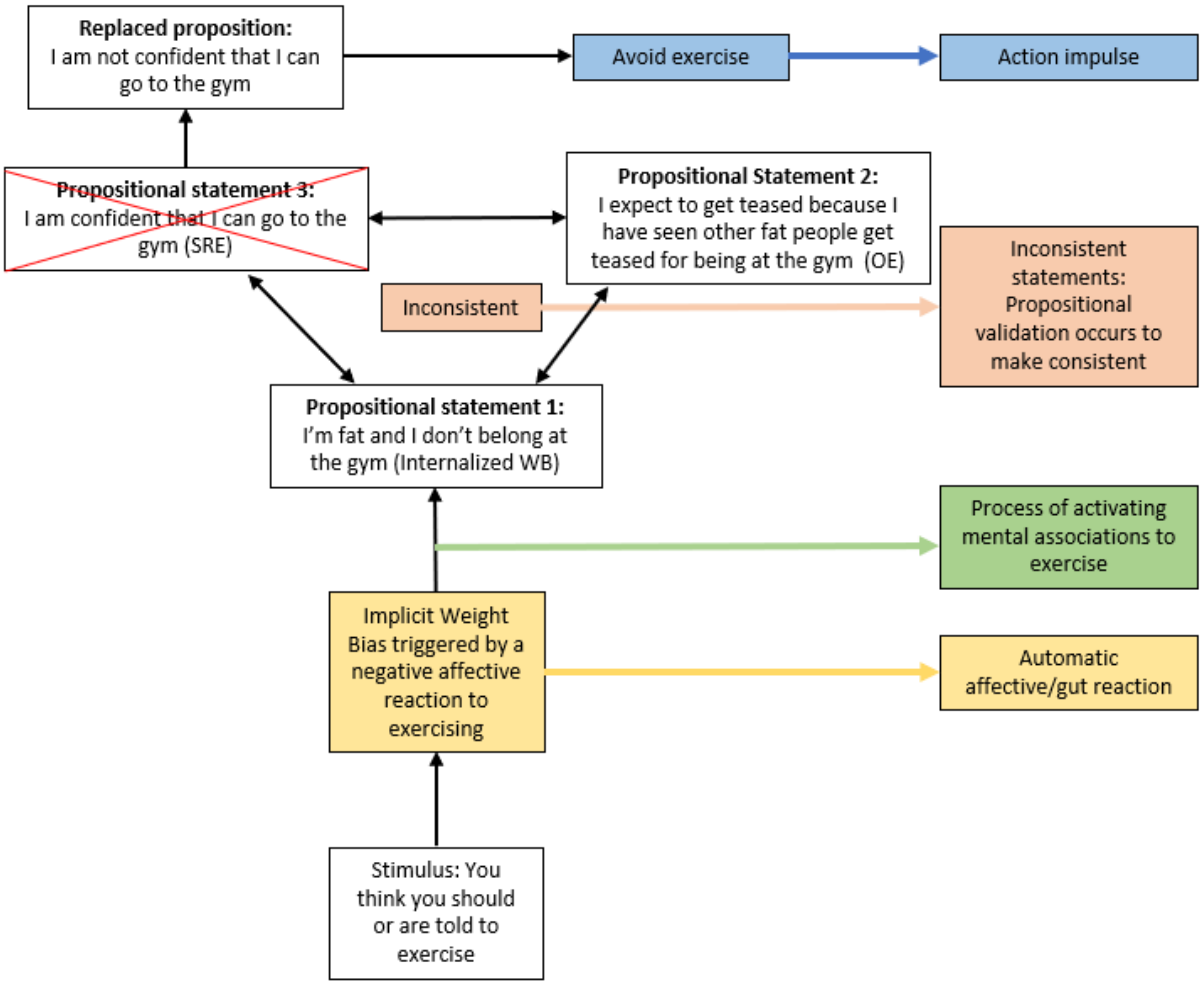
Replaced proposition:
I am not confident that I can go to the gym
Avoid exercise
Action impulse
Propositional statement 3:
I am confident that I can go to the gym (SRE)
Propositional Statement 2:
I expect to get teased because I have seen other fat people get teased for being at the gym (OE)
Inconsistent
Inconsistent statements: Propositional validation occurs to make consistent
Propositional statement 1:
I'm fat and I don't belong at the gym (Internalized WB)
Process of activating mental associations to exercise
Implicit Weight Bias triggered by a negative affective reaction to exercising
Automatic affective/gut reaction
Stimulus: You think you should or are told to exercise

Figure 1b

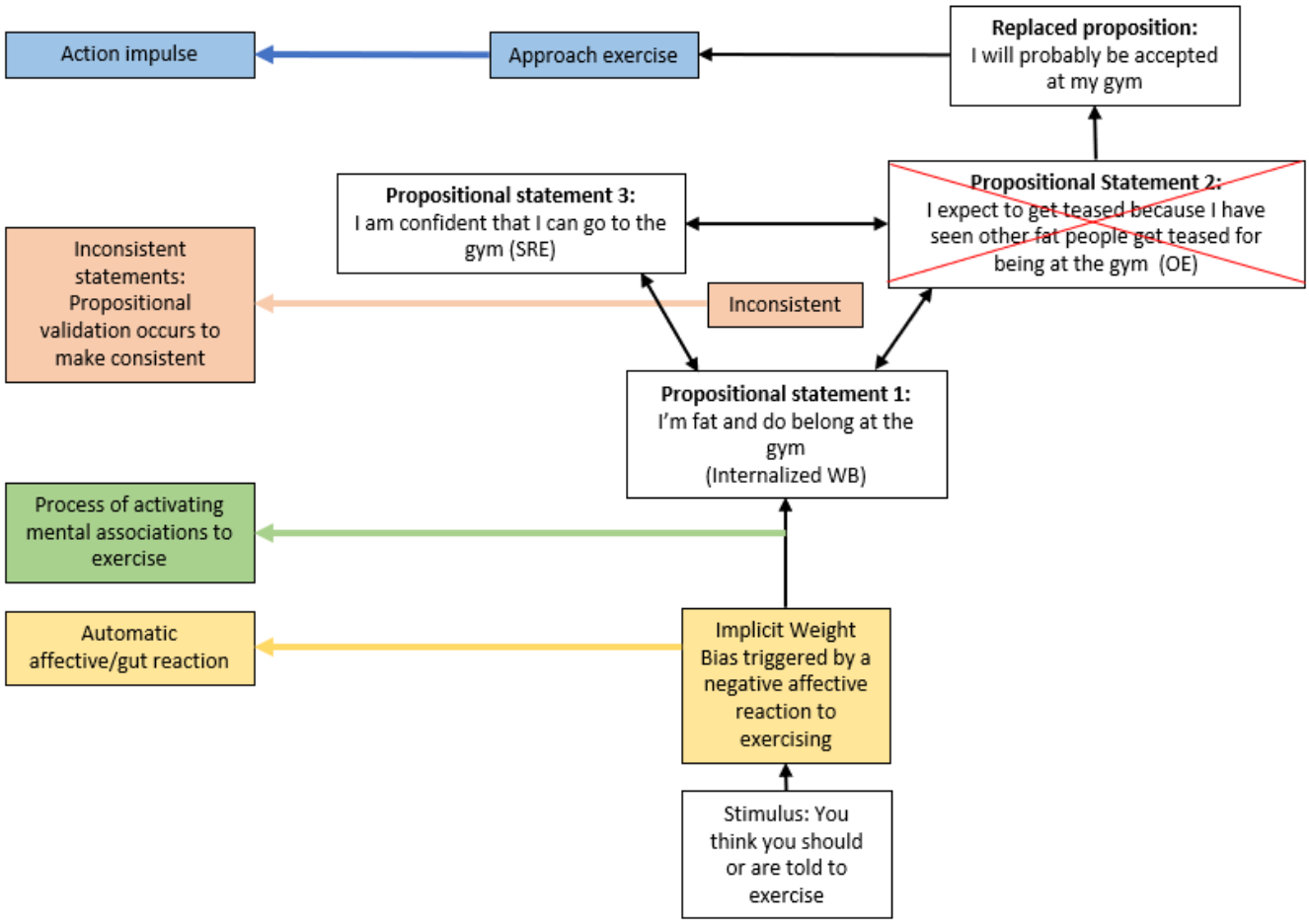

Figure 1c

Figures 1a, b, & c depict the negative affective reaction, brough on by an exercise or PA related stimulus, which then activates mental associations to propositional statement 1 (reflects *Internalized WB* or internalized weight bias), which is then related to pre-existing propositional statements 2 (reflects *SRE* or the availability of self-regulatory efficacy resources) and 3 (reflects *OE* or the outcome expectation of experiencing stigma). When all propositional statements are inconsistent, in order to avoid feelings of cognitive dissonance, one of the propositional statements must be re-assessed through the process of propositional validation. How consistency can be achieved depending on the availability of self-efficacy and outcome expectation resources. Rejection of propositional statement 3 (fig. 1b) results in an action impulse that works to avoid exercise, where as the rejection of propositional statement 2 (fig. 1c) results in an action impulse that works to approach exercise.

Previous studies have used both propositional and associative cognitions to examine weight stigma and internalized weight bias for people in larger bodies. However, the main

limitation of these studies is that they either use an *explicit* survey measure for assessing internalized weight bias (like the Weight Bias Internalization Scale) or an *implicit* measure (like the implicit association task) to assess internalized weight bias (Hubner et al., 2016; Hinman et al., 2015). A stronger test of the dual processing model would be to examine *implicit* measures along with *internalized* measures of weight bias. Examining behavioural engagement through a dual process lens necessitates the application of behaviour change theories (i.e., social cognitive theory) that focus on explicit cognitions that operate on the propositional level. Social Cognitive Theory specifies certain individual-level social cognitions that drive behaviour change. The confidence to regulate PA (self-regulatory efficacy) and the expected outcomes of being physically active (i.e., propositional statements 2 and 3) are two explicit evaluations that theory and research suggest are important antecedents predicting PA (Connor & Norman, 2015).

Social Cognitive Theory (SCT)

Social cognitive theory is an influential theory of reflective human motivation as it suggests that action is extensively regulated by forethought. The agency components of social cognitive theory outline two main factors that influence behavior: self-efficacy and outcome expectations (Bandura, 1986). Self-efficacy is defined as the confidence one has in their own skills and abilities to perform a given task. Self-efficacy influences how individuals prepare for action because self-related cognitions are a major ingredient in the motivation process.

Self-efficacy determines how much effort is expended towards making a behaviour change and how long that effort is sustained for, especially when encountering obstacles that are known to impede motivation (Bandura, 1997). Bandura specifies two forms of self-efficacy: self-efficacy to perform discrete tasks and self-efficacy to self-regulate one's own thoughts, feelings, and behaviours. Task self-efficacy represents the belief an individual has in their capability to

perform a given task successfully. Self-regulatory efficacy (SRE) refers to an individual's confidence in their ability to regulate their thoughts, feelings, and actions in order to work towards a personal goal (i.e., propositional statement 3; "I am/am not confident to exercise in public"). For the purposes of this study, we will be examining self-regulatory efficacy (SRE) as pervious studies have examined SRE as the most relevant psychosocial determinant of PA (Hubner et al., 2015).

Outcome expectations represent one's judgement of the likely consequences that will occur as a result of performing or not performing a particular behaviour. There are generally considered to be three types of outcome expectancies: physical, social and self-evaluative (Young et al., 2014). Physical outcome expectations reflect beliefs about pleasant and aversive physical experiences resulting from engagement in PA. Social expectations reflect beliefs about PA resulting in increased opportunities for socialization and attaining social approval. Finally, self-evaluative outcome expectations capture beliefs relative to the feelings of satisfaction and self-worth associated with involvement in PA (Wojcicki et al., 2009). For people in larger bodies, their attempts to participate in PA maybe be discouraged due to the social expectation of being discriminated against because to their size.

Overall, social cognitive theory outlines two psychosocial outcomes (i.e., self-efficacy and outcome expectations) that are (a) explicitly-measured and (b) evidence-based factors that regulate PA engagement. However, social cognitive theory focuses solely on the propositional system and doesn't take associative behaviour into account. The current study uses a dual process approach with social cognitive theory driving the examination of explicit-level social cognitions to understand the impact of internalized weight bias on PA behavior and related cognitions.

Explicitly assessed Internalized Weight Bias

Internalized weight bias results from internalizing the social devaluation and size bias experienced by people in larger bodies. Weight bias can be internalized implicitly and explicitly; both require different approaches to measurement. Weight bias has been measured explicitly, using Weight Bias Internalization Scale (Durso & Latner, 2008), and implicitly using an Implicit Association Task (IAT) (Hinman et al., 2015). The negative self-beliefs formed by an individual's internalized weight bias have been known to dissuade exercise, especially for people in larger bodies (Bevan et al, 2022; Gumble & Carels, 2012; Forbes & Donovan, 2019). In order to be active, people in larger bodies need to be able to regulate and have the self-confidence to regulate any negative self-beliefs (i.e., propositional statement 2; "People in larger bodies get made fun of at the gym"). Internalised weight bias has been shown to mediate the relationships between explicit weight stigma and behavioural engagement (e.g., reduced exercise, disordered eating; Bevan et al, 2022; Gumble & Carels, 2012; Forbes & Donovan, 2019; Hinman et al., 2015). Forbes and Donovan (2019) found that internalised weight stigma also mediated the relationship between experienced weight stigma and body shame such that greater experienced weight stigma led to greater internalised weight bias, which in turn led to greater body shame. These results indicate that internalised weight bias is an important driving mechanism in the relationship between experienced weight stigma and body-oriented outcome variables (i.e., body shame). These findings suggest that an experience of weight stigma in and of itself does not necessarily mean an individual will try to avoid PA. Rather, the extent to which the stigma becomes internalized may be the factor driving PA behaviour for people in larger bodies.

Another study by Pearl et al. (2015) investigated the separate effects of weight stigma experiences and weight bias internalization on exercise motivation, behavior, and weight-biased attitudes among individuals in larger bodies. The study found that experiencing weight stigma

and the extent to which the weight stigma was internalized represents two distinct phenomena. Weight bias internalization (but not weight stigma experiences) was associated with greater belief in weight controllability and fat phobia. Internalized weight bias has been shown to negatively effect perceptions of self, resulting in greater body shame and lower perceived self-efficacy and self-esteem (Forbes & Donovan, 2019). These findings are concordant with other evidence, suggesting that self-directed stigma leads to a "why try" effect (i.e., exercise avoidance) which causes individuals to lose self-efficacy and motivation to achieve goals (Perl et al., 2015). This contributes to explanations of why weight bias internalization may be associated with negative physical health functioning.

Implicitly assessed Internalized Weight Bias

Hinman et al. (2015) examined the effects of internalized weight bias on various psychological measures such as appearance orientation, overweight preoccupation, and anti-fat attitudes. Internalized weight bias was measured implicitly using an IAT, which tasked the participants with pairing images that depicted individuals in smaller and larger bodies doing stereotypically congruent and incongruent tasks (i.e., people in larger bodies were shown engaging in stereotype congruent 'unhealthy' behaviors like watching TV and eating junk food and stereotype incongruent 'healthy' behaviors like exercising or preparing vegetables) which were paired with "good" and "bad" category labels. The participant's reaction time was measured, such that a faster reaction time to categorize stereotype congruent images with "Good" concepts were indicative of implicit weight bias. The study found that stereotype congruent implicit weight bias was significantly associated with overweight preoccupation (i.e., the anxiety and vigilance regarding weight gain and body size), appearance orientation (i.e., investment in personal appearance), fear of fat, and dislike of people in larger bodies.

Gumble and Carels (2012) also administered an IAT, using four different trials which measured implicit attitudes of people in larger bodies towards weight bias, weight identity, self-esteem and body image. The study also measured explicit attitudes towards people in larger bodies, but the findings were not significant. For implicit measurement of weight bias, participants were asked to categorize attribute words into the categories of good/thin and bad/fat followed by good/fat and bad/thin. For measurement of weight identity, participants were asked to categorize attribute words into the categories of self/thin and other/fat followed by self/fat and other/thin. For measurement of self-esteem, participants were asked to categorize words into the categories of good/self and bad/other followed by good/other and bad/self. For measurement of body image, participants were asked to categorize attribute words into the categories of self/attractive and other/unattractive followed by self/unattractive and other/attractive. For people in larger bodies, greater implicit weight bias was associated with lower appearance evaluation, lower body area satisfaction, lower implicit self-esteem, and more negative implicit body image. People in larger bodies may have implicitly internalized weight bias and therefore viewed themselves as less attractive and less capable. In contrast, for people in smaller bodies, the study found that greater implicit weight bias was associated with a higher appearance evaluation and body areas satisfaction, higher self-esteem, and a more positive body image. These findings suggest that individuals in smaller bodies may make ego enhancing downward comparisons by comparing themselves to individuals in larger bodies. This demonstrates that implicit weight bias may be associated with factors related to internalized weight bias (Gumble & Carels, 2012; Pearl et al., 2015). Both these studies measured internalized weight bias by using an implicit measure, whereas it is possible that internalized weight bias maybe present at both the implicit and explicit level. Therefore, internalized weight bias should be assessed at both the implicit and explicit levels. Examining internalized weight bias, through only implicit or explicit measures is a

limitation of the existing literature. Further, investigations that have sought to examine weight stigma with implicit measures (Hinman et al., 2015; Gumble & Carels, 2012) have used explicit measures of weight stigma that focus on social perceptions of weight stigma rather than internalized perceptions (e.g., social perception: "fat people are lazy" VS internalized perception: "I am lazy because I am fat"). Examining internalized weight bias alongside an implicit measure also fills a gap in past research.

Self-regulatory efficacy

Self-regulatory efficacy, as compared to task self-efficacy, has typically been studied as a predictor of PA maintenance given that regular PA requires a variety of self-regulatory skills (Connor & Norman, 2015). To be active, people in larger bodies may have to regulate their thoughts and emotions related to their past and expected experiences of weight-based discrimination in PA environments. Self-regulatory efficacy has previously been shown to be related to internalized weight bias and PA for people in larger bodies (Hubner et al., 2015).

According to Bandura, individuals form their self-efficacy beliefs by interpreting information from four different sources (Bandura, 1997). Internalized weight bias may be indicative of these sources of information, suggesting the potential relationship between self-regulatory efficacy and internalized weight bias. The first source to inform is through personal accomplishments or mastery experiences; individuals engage in tasks and activities, interpret the results of their actions, use the interpretations to develop beliefs about their capability to engage in subsequent tasks or activities, and act in concert with these created self-efficacy beliefs. The successful performance of a behaviour should raise self-efficacy, whereas those interpreted as failures lower self-efficacy (Schunk & Pajares, 2010). In this particular context, individuals in larger bodies may try to exercise and be physically active but if they experience weight-stigma

while trying to be physically active, they may interpret this negative experience as a personal failure, lowering their self-efficacy beliefs. A second source of self-efficacy is through vicarious experiences (i.e., observing others perform tasks). For example, at the gym, people in larger bodies may observe other people in the same space and make comparisons that lead to them to internalizing more weight bias beliefs, which can then negatively affect their self-efficacy (Thedinga et al., 2021). Individuals also develop self-efficacy beliefs as a result of the social persuasions they receive from others. For people in larger bodies, their experiences of weight-based discrimination, and other verbal judgements can be a source of internalized weight bias, lowering self-efficacy beliefs. Finally, the third and fourth sources of information include physiologic and emotional states such as anxiety, stress, arousal, and mood states also influence efficacy beliefs. People gauge their degree of confidence by the emotional state they experience, as they contemplate an action. For people in larger bodies, the negative emotional state associated with exercising resulting from internalized weight bias may inhibit their self-efficacy (Nutter et al., 2023).

Hubner et al. (2015) measured internalized weight bias and general self-efficacy in relation to PA and found that weight bias internalization was negatively related to general self-efficacy and PA. Moreover, Major et al. (2020) examined the countervailing effects of experienced weight discrimination on weight loss motivation and self-efficacy for weight control. The study found that exposure to weight-based discrimination led to an increased motivation to lose weight, but a decreased perceived capacity to do so (i.e., self regulatory efficacy). These relationships could suggest that, for individuals in larger bodies, internalized weight bias might be a source of information that individuals draw from to form self-efficacy beliefs, which then negatively influences their ability to participate in regular PA.

Past studies have measured self-efficacy using barrier or task self-efficacy scales. These measures are often more focused on measuring behavioural outcomes (i.e., goal setting, planning) and do not speak to the emotional or cognitive regulation skills that individuals in larger bodies must possess in order to self-regulate to be physically active. Therefore, this study will be using a self-regulatory efficacy scale that specifically includes the cognitive and emotional regulation skills needed to manage thoughts and behaviours (Schwarzer & Jerusalem, 1995).

Stigma outcome expectations

Outcome expectations refer to the anticipated consequences (positive or negative) of engaging in a behaviour (Bandura, 1986; Ressor et al., 2017). For people in larger bodies, past experiences of weight stigma and internalized weight bias may lead to negative social expectations about being physically active. For this study, outcome expectations are operationalized as the anticipation of experiencing weight-based stigma or discrimination, particularly when being physically active in a public setting. The concept of expected or anticipated stigma has been previously studied for people in larger bodies, referring to the intrapersonal, internal cognitive phenomenon of beliefs and expectations that one will be mistreated in the future. Anticipated weight stigma can arise both from previous experiences with discrimination, as well as from situational cues that signal the potential for discrimination (e.g., going into a setting that tends to be appearance-focused, like a gym; Hunger et al., 2020). Anticipated weight stigma can also arise in the form of vicarious experiences portrayed in TV media (i.e., reality style TV shows such as the Biggest Loser, My 600-lb life etc.) and social media (i.e., #gymfails etc.). Several studies have shown that people in larger bodies expect to be discriminated against and mistreated in PA spaces (Bevan et al., 2022; Thedinga et al., 2021; Hunger et al., 2020). Encountering weight-stigmatizing messages directly heightens anticipated

stigma. Anticipated stigma has downstream implications for both heightened motivations to engage in extreme behaviors to achieve weight loss and decreased perceived capacity for weight control (Major et al., 2020). Additionally, these findings suggest that anticipated stigma may be a predictor of PA engagement for people in larger bodies.

Exercise intention and avoidance

Internalized weight bias has been consistently linked to exercise avoidance across two quantitative studies. Vartanian and Novak (2011) examined internalized weight bias as a moderator of the association between weight stigma and avoidance of exercise. The study found that the relationship between weight stigma and avoiding PA was moderated by internalized weight bias, such that greater internalized weight bias led to a greater tendency to avoid PA.

Another study by Bevan et al. (2021) examined the relationship between experiences of weight stigma, physical appearance related concerns, and avoidance of PA and sport. The study found that weight stigma, weight bias internalization and appearance evaluation were all associated with lower enjoyment of, and greater tendency to avoid PA and sport. Additionally, experiences of weight stigma were associated with lower appearance evaluation, which was associated with greater weight bias internalization, which in turn was associated with less enjoyment of PA and sport. These findings suggest that individuals who experience greater weight stigmatization, report a greater tendency to want to avoid PA and sport, and are less likely to participate in sport. The impact of experiencing and internalizing weight bias has been reportedly worse for women, when compared to men (Bevan et al., 2022; Gumble & Carels, 2012). Recent literature has found that women may be particularly likely to internalize sociocultural messages about ideal body shape and weight and, in turn, may avoid participating in activities such as PA and sport where their physical appearance may be judged (Bevan et al., 2022; Thedinga et al., 2021).

There is also qualitative evidence supporting the notion that past experiences can cause people in larger bodies to expect to experience weight discrimination when being physically active. Thedinga et al. (2021) examined the extent to which PA is avoided among individuals in larger bodes. The study found that individuals in larger bodies excluded themselves from PA settings because of a variety of weight stigma experiences, self-discriminatory attitudes, and anticipated fear of stigmatization. The findings suggest that self-exclusion from sport and exercise settings is to a large extent the result of past 'traumatic and memorable' stigma experiences that are internalized in similar settings across the life span.

It is evident that past discriminatory experiences cause people in larger bodies to anticipate weight-based discrimination in PA spaces. Within a SCT framework, this expectation is an important social cognition for PA regulation. The purpose of the current study was to examine the relationship between internalized weight bias (implicitly and explicitly measured) and PA cognitions through a dual process perspective. Deliberative factors like internalized weight bias and stigma-related outcome expectations have consistently been shown to dissuade PA, whereas self-efficacy and positive outcome expectations have been shown to encourage PA (Meadows & Bombak 2019).

Research Questions

1) Are internalised and implicit weight bias associated with PA participation for women in larger bodies?
2) Are internalized and implicit weight bias related to PA avoidance for women in larger bodies?
3) Are internalized and implicit weight bias associated with self-efficacy in women with larger bodies?

Hypotheses

H1: Internalized weight bias and implicit weight bias will be significantly positively associated with the expectation of experiencing weight related stigma.

H2: Internalized weight bias and implicit weight bias will be significantly negatively associated with self-regulatory efficacy.

H3: Internalized weight bias and implicit weight bias will be significantly negatively associated with the tendency to avoid PA.

H4: Internalized weight bias and implicit weight bias will be significantly negatively associated with PA intention

H5: Internalized weight bias and implicit weight bias will be significantly negatively associated with self-reported MVPA.

H6: Internalized weight bias and implicit weight bias will be significantly negatively associated with light PA.

Methods

Participants & Procedures

Aligning with the inclusion criteria of similar studies (Bevan et al, 2021), all eligible participants were over 18, self identified as a woman, had a BMI over 25 and self-identified their body weight as being ‘overweight’ or ‘obese’. The study only tested individuals who self-identified as being a woman, as experiences of weight stigma and internalized weight bias are more prevalent in women (Bevan et al., 2022; Vartanian & Novak, 2011). Participants were

excluded if they were pregnant or on any medication/ had a medical condition that could affect their weight or appetite (Decker, 2018).

Participants were recruited through the Prolific recruitment panel (prolific.com). Prolific is an online participant recruitment platform that uses software to verify participants in the database based on their government issued identification. It is often the case that up to 10% of participants do not end up with a valid IAT score which means they are not able to be included in the analyses and need to be replaced (Gumble & Carels, 2012). Participants were recruited in batches of 40, participants with invalid IAT scores were removed, then another batch of 40 was recruited. The purpose of this was to get as close to our target sample size without oversampling by recruiting too many participants.

Ethics clearance was obtained by the institution's review board (See appendix 1), and participants provided informed consent. Participant's BMI was calculated from self-reported height and weight. Participants were also asked to self-identify their body weight from 1 (Very Underweight) to 5 (Very Overweight/Obese). Additional demographic characteristics such as age, ethnicity, annual income, highest level of education were also collected. Gender identity and weight identity were used as screening tools for inclusion purposes. Individuals who did not self-identify as a woman were thanked for their time but did not participate further.

Measures

Demographics: self reported height and weight, age, ethnicity, annual income, highest level of education, relationship status, whether participants had any children, the number of children they had, and time they spent (years) living in a larger body.

PA was measured using the Godin Leisure Time PA Questionnaire. This validated scale uses three items that ask participants to self-report the number of PA bouts performed in the past

seven days, at three different intensity levels: mild, moderate, and vigorous (Godin & Shephard, 1985). Two PA variables were created from this measure. The number of bouts of purposeful (not incidental) moderate and vigorous PA (MVPA) were summed, as an accepted measure of exercise (Motl et al., 2018). The total number of bouts of light PA was used as the second PA measure. Light PA and MVPA were examined as separate outcomes because they represent different PA behaviours, for which one (MVPA) is directly linked to the Canadian PA guidelines (Mottl et al., 2018).

PA intention was measured using three questions: "I plan to do moderate to vigorous activity of at least 30 minutes for __ number of times over the next 7 days?" (using an 8-point Likert scale; 0 = "0 times over the next seven days" and 7 = "7 times over the next seven days"); "I plan to walk or do light activity of at least 30 minutes for __ number of times over the next 7 days?" (using an 8-point Likert scale; 0 = "0 times over the next seven days" and 7 = "7 times over the next seven days"); "To what degree do you intend to be physically active over the next 7 days?" (using a 5-point Likert scale; 1 = "very weakly" and 5 = "very strongly") (Rhodes & Rebar, 2017). This scale was created based on recommendations from Rhodes and Rebar (2017). Rhodes and Rebar (2017) provided evidence of construct validity for measuring 2 types of intention: decisional intention and intention strength. Decisional intention measures the decisional direction to enact on or avoid a behaviour, whereas intention strength measures the intensity of the commitment to enact on said behaviour. (Rhodes & Matheson, 2005; Rhodes & Rebar, 2017). The three items were averaged. In the current study, Cronbach's α was .70.

Self-regulatory efficacy was measured using Schwarzer and Jerusalem's general self-efficacy scale (Schwarzer & Jerusalem, 1995). The scale assessed the confidence to use different self-regulatory skills (e.g., "I can remain calm when facing difficulties because I can rely on my

coping abilities"). Past evidence has suggested that this is a reliable and valid unidimensional measure across different cultural contexts (Schwarzer & Jerusalem, 1995). The scale consists of 10 items that assesses the self-regulatory efficacy to manage thoughts and behaviours, on a 4-point scale. (1 = not true at all to 4 = exactly true) (Schwarzer & Jerusalem, 1995). The overall scale mean was used in the analysis. In the current study, Cronbach's α was .89.

Outcome expectations was measured using the Fear of Appearance Evaluation Scale (FAES; Bevan et al., 2021). It is a validated 6-item scale assessing people's fear or worry regarding the potential of others to make evaluations of their physical appearance. Participants were asked to answer what comes closest to how they feel (e.g., "It bothers me if I know someone is judging my physical shape") using a 5-point scale (1 = not at all to 5 = extremely) (Bevan et al., 2021). The overall scale mean was used in the analysis. In the current study, Cronbach's α was .93.

PA avoidance was measured using the Tendency to Avoid PA (TAPA) scale (Bevan et al., 2022). It is a validated 5-item scale and included items such as "I avoid PA because I don't like how my body looks when exercising". Participants will indicate their agreement or disagreement using a five-point scale (1 = strongly disagree to 5 = strongly agree). Scores from the five items of the TAPA scale are summed to provide a score ranging from 10–50, with higher scores indicating greater avoidance of PA and sport (Bevan at al., 2022). In the current study, Cronbach's α was .92.

Implicit weight bias was measured using a single category Weight Implicit Association Task (IAT) (Greenwald & Banaji, 1998), a validated and widely used measure for assessing implicit attitudes (Greenwald & Banaji,1998). All tests were performed using Inquisit Software.

The participants were shown images of stereotypically congruent body silhouettes of "fat" people and tasked with pairing these stimuli with "good" and "bad" word categories (i.e., "Good" word category: Joy, Love, Peace, Wonderful, Pleasure, Glorious, Laughter, Happy; "Bad" word category: Agony, Terrible, Horrible, Nasty, Evil, Awful, Failure, Hurt). The IAT consisted of 7 block trials; the first two trials familiarize the participant with the task and the remaining five trials assess participant's implicit biases. The IAT produces an overall D-score that ranges from -1 to +1, based on the participant's reaction time, when pairing stimuli images with words. A positive D-score supports a stronger association between "fat" silhouettes & "good" words category, whereas a negative D-score support a stronger negative association between "fat" silhouettes & "bad" words category. For example, a positive D-score would indicate a faster reaction time to categorize stereotypically congruent body silhouettes of "fat" people with "good" concepts, which would be indicative of a positive or favourable implicit association towards people in larger bodies (Greenwald & Banaji, 1998).

Internalized weight bias was explicitly measured using the modified Weight Bias Internalization Scale (WBIS; Durso & Latner, 2008). This is a validated measure that examines the degree to which a respondent believes that negative stereotypes and negative self-statements about people in larger bodies applies to themselves. Participants will be asked to indicate the extent to which they agree with statements about themselves (e.g., "My weight is a major way that I judge my value as a person") using a 7-point scale (1 = strongly disagree to 7 = strongly agree). A mean score of all 11 items was calculated for each participant, with WBIS scores ranging from 1 to 7 and higher scores indicating greater weight bias internalization. (Durso & Latner, 2008) In the current study, Cronbach's α was .9.

Analytic plan

Descriptive statistics were run to describe our sample. Next, correlations were run to examine the nature of the bivariate relationships between all study variables. Multivariate statistical assumptions were tested and managed prior to the main analyses in line with Field (2018) and Tabachnick and Fidell (2007). The assumption of normality was assessed using Skewness and Kurtosis statistics. The assumption was met, as the values did not exceed 2. The assumption of influential multivariate outliers was assessed using Mahalanobis distance. The assumption was met if observed values do not exceed the Chi square critical value. The absence of influential multivariate outliers was determined if observed scores on Cook's distance did not exceed 1. The assumption of multicollinearity was assessed through the VIF and tolerance statistics. The assumption was met if observed VIF values did not exceed the critical value of 10. Finally, the assumption of independence of errors was assessed using the Durbin-Watson statistic. The assumption will be met if observed values fall between 1.5 and 2.5 suggesting uncorrelated residuals (scores can range from 0-4). Only cases with complete data were used in the analysis, thus listwise deletions were made for cases with missing data per SPSS default.

After meeting statistical assumptions, hierarchical multiple regression was used to examine the study hypotheses. In step one of the regression, age, BMI, and PA were entered as co-variates (Durso & Latner, 2008; Bevan et al., 2021). In step 2, implicit weight bias was entered into the regression, and finally, in step 3, internalized weight bias was entered. Implicit measures typically have a weaker association to social cognitive and behavioural variables than do explicit measures (Phelan et al., 2014). For this reason, implicit weight bias was entered in the regression before explicitly assessed internalized weight bias. All statistics were run using SPSS version 29.

Sample size calculation

A projected minimum sample size of 148 participants was calculated using Gpower version 3.1.9.2. based on a regression model analysis, p <.001, power of 0.80, 2 predictors, and a medium effect size (f2 = .067) based on previous findings examining interaction between weight bias internalization and the tendency to avoid PA in Bevan et al. (2021). The decision to add covariates was made after data collection was completed. The impact of this on reducing statistical power is discussed in the limitations section.

Results

The study examined implicit and internalized weight bias as significant predictors of the expectation of experiencing weight stigma, the tendency to avoid PA, self-regulatory efficacy, PA intention, past MVPA and past light PA. First, the study demographics will be discussed, followed by a review of the study variable descriptives and correlations. Finally, the results and findings for each of the hypotheses will be presented. All demographic information, correlation and regression analyses will also be presented in a table format at the end of the chapter.

Demographics

A total of 181 participants provided informed consent, of which 27 were ineligible due to incomplete screening response questions or they did not meet the eligibility criteria leaving a final sample of $N = 154$. All participants identified as cisgender women. They had a mean age of 27.92 years ($SD = 4.57$); the mean BMI was 33.13 ($SD = 6.88$). All findings from the demographics are summarized in Table 1.

Table 1. Demographic information.

Demographic variable		(n = 154)
Age M (SD)		27.92 (4.57)
BMI M (SD)		33.13 (6.88)
Gender n (%)	Cisgender Woman	154 (100)
Ethnicity n (%)	Caucasian	89 (57.8)
	South Asian	14 (9.1)
	East Asian	25 (16.23)
	African	11 (7.14)
	Middle Eastern	5 (3.24)
	Indigenous	6 (3.9)
	Hispanic/ Latin American	1 (0.64)
	Mixed race	3 (1.95)
Relationship Status n (%)	Married	37 (24.02)
	Single	64 (41.55)
	Domestic Partnership	45 (29.22)
	In a relationship	6 (3.9)
	Divorced	2 (1.3)
Education n (%)	College Diploma/ Trades	27 (17.53)
	Master's Degree or higher	34 (22.08)
	High school diploma	27 (17.53)
	Undergraduate Degree	65 (42.2)
	Did not complete high school	1 (0.65)
Annual Income n (%)	$29,999 - $49,999	41 (26.62)
	$50,000 - $99,999	52 (33.76)
	$100,000 - $150,000+	49 (31.81)
	Did not disclose	12 (7.8)
Number of Kids n (%)	No kids	128 (83.1)
	1 – 3 Kids	26 (16.9)
Larger Body n (%)	Less than 5 yrs.	41 (26.6)
	Past10-15 yrs.	30 (19.5)
	Past 5-10 yrs.	39 (25.3)
	All my life	44 (28.6)

Descriptive Statistics and Correlations

The study measured implicit association towards people in larger bodies through an IAT, where a positive D Score indicates a positive bias, and a negative D Score indicated a negative bias towards people in larger bodies. The mean D Score was - .03 (*SD* = 0.28), which indicated a slight negative bias towards people in larger bodies. The skewness value (-.259) and the kurtosis value (.190) did not exceed 2, meeting the assumption of normality. Internalized Weight Bias was measured using the weight bias internalization scale (*M* = 4.67, *SD* = 1.27) which uses a 7-point Likert scale, with higher scores indicating greater weight bias internalization. The skewness value (-.350) and the kurtosis value (-.325) did not exceed 2, meeting the assumption of normality.

The expectation of experiencing weight stigma was measured using the FAES scale (*M* = 3.88, *SD* = 1.01), which uses a 4-point Likert scale, where higher scores indicate a greater fear and expectation of experiencing weight stigma. The skewness value (-.953) and the kurtosis value (.227) did not exceed 2, meeting the assumption of normality.

The tendency to avoid PA (*M* = 15.56, *SD* = 6.03), was measured using the TAPAS scale; the scores are summed and can range from 10-50, with higher scores indicating greater avoidance of PA. The skewness value (-.047) and the kurtosis value (-1.24) did not exceed 2, meeting the assumption of normality.

Self-regulatory efficacy was measured using Schwarzer and Jerusalem's general self-efficacy scale (*M* = 29.12, *SD* = 5.78). The scores are summed, ranging from 10-40, and a higher score indicates higher perceived general self-efficacy, and a lower score indicates lower

perceived general self-efficacy. The skewness value (.624) and the kurtosis value (.678) did not exceed 2, meeting the assumption of normality.

PA intention was measured using 3 separate Likert scale questions and the responses were averaged (M = 3.10, SD = 1.34). The skewness value (-.013) and the kurtosis value (-.443) did not exceed 2, meeting the assumption of normality.

Light PA was measured using the Godin Leisure Time PA Questionnaire (M = 3.44, SD = 3.37). The skewness value (1.2) and the kurtosis value (1.15) did not exceed 2, meeting the assumption of normality.

Moderate to vigorous PA (MVPA) was also measured using the Godin Leisure Time PA Questionnaire (M = 4.16, SD =4.48). The skewness value (1.44) and the kurtosis value (1.77) did not exceed 2, meeting the assumption of normality. All findings for the correlation analysis are summarized in Table 2.

Table 2. Variable means and correlations.

Variables	Mean (SD)	BMI	Implicit Weight Bias	Internalized Weight Bias	FAES	TAPAS	PA Intention	MVPA	Light PA
BMI	33.13 (6.88)	-							
Implicit Weight Bias	-.03 (0.286)	-.059	-						
Internalized Weight Bias	4.67 (1.27)	.160*	-.179*	-					
Fear of Appearance Evaluation (FAES)	3.88 (1.01)	.106	-.198*	.758**	-				
Tendency to Avoid Physical Activity (TAPAS)	15.6 (6.02)	.244**	-.171*	.545**	.585**	-			
PA Intention	3.10 (1.34)	-.125	.112	-.054	-.063	-.263*	-		
MVPA	4.16 (4.48)	.039	.039	.025	.019	-.221**	.483**	-	
Light PA	3.44 (3.37)	.076	-.178*	-.120	-.028	-.033	.291**	.158	-
SRE	29.12 (5.78)	-.034	.313**	-.276**	-.198*	-.255**	.286**	.148	.078

Note: *p < .05; **p < .01; ***p < .001; SRE = Self-Regulatory Efficacy

Hypotheses

Table 3 contains a summary the findings from all of the hypotheses.

Table 3: Regression Results Summary

Dependent Variable	Implicit weight Bias (Step 2)	Implicit weight Bias (Step 3)	Internalized weight Bias
Outcome Expectations	-	NS	+
Self-Regulatory Efficacy	+	+	-
Tendency to Avoid Physical Activity	-	NS	+
Physical activity Intention	NS	NS	NS
Past MVPA	NS	NS	NS
Light Physical Activity	-	-	-

Note: NS= Not Significant findings. This table overviews the key associations between implicit and internalized weight bias and study outcomes.

H1: Internalized weight bias and implicit weight bias will be significantly associated with expectation of experiencing weight related stigma.

Prior to conducting the hierarchical regression analysis, statistical assumptions for multiple regression were checked to ensure there were no violations. There were no multivariate outliers as the Mahalanobis statistic of 21.37 was under the chi square critical value (X^2 = 22.46, *df* = 6) and Cook's distance of .007 was less than 1, meeting this assumption. The assumption of independence of errors was considered met, as the Durbin-Watson statistic of 1.89 was between 1.5 and 2.5. The final tested assumption was multicollinearity, which was also satisfied as all VIF values were less than 1.2. Based on these statistics, no assumptions were violated, and we proceeded with the regression analysis.

In step 1 of the multiple regression where covariates were entered, only age was significantly associated with expected weight stigma (B = -.262, p <.01). In step 2, implicit

weight bias was added to the regression and was significantly related to expected weight stigma (B = -.203, p < .05). As the implicit association towards people in larger bodies became more negative (D score decreased), expected weight stigma increased and this effect size was small to medium sized (Cohen et al., 2003; Field, 2009). In the final step, internalized weight bias was added into the regression and was significantly associated with expected weight stigma (B = .737, p <.001). Once internalized weight bias was added into the equation, implicit weight bias became not significant. As internalized weight bias increased, so did expected weight stigma and this effect size was large in magnitude. Together, the model accounted for 59.3% of the variance in the expectation of experiencing weight stigma. On its own, implicit weight bias was associated with expected weight stigma, however, when internalized weight bias was added to the equation it became non-significant. See table 4 for the full regression results.

Table 4. Hierarchical multiple regression results for predicting the expectation of experiencing weight related stigma.

Variable	β	Model statistics
DV: Fear of Appearance Evaluation		
Step 1:		$F(4,145) = 3.18$, $p < .01$, $r^2 = .081$
MVPA	.033	
Light PA	-.034	
Age	-.262**	
BMI	.153	
Step 2:		$F(5,144) = 3.93$, $p < .05$, $r^2 = .120$
MVPA	.047	
Light PA	-.071	
Age	-.258***	
BMI	.143	
Implicit Weight Bias	-.203*	
Step 3:		$F(6,143) = 34.75$, $p < .001$, $r^2 = .593$
MVPA	.002	
Light PA	.055	
Age	-.107	
BMI	-.004	
Implicit Weight Bias	-.056	
Internalized Weight Bias	.737***	

Note: *$p < .05$; **$p < .01$; ***$p < .001$; Physical activity = PA; moderate-to-vigorous PA = MVPA.

H2: Internalized weight bias and implicit weight bias will be significantly associated with self-regulatory efficacy.

Prior to conducting the hierarchical regression analysis, statistical assumptions for multiple regressions were checked to ensure there were no violations. There were no multivariate outliers as the Mahalanobis statistic of 21.37 was under the chi square critical value (X^2 = 22.46, *df* = 6) and Cook's distance of .007 was less than 1, meeting this assumption. The assumption of independence of errors was considered met, as the Durbin-Watson statistic of 2.21 was between 1.5 and 2.5. The final tested assumption was multicollinearity, which was also satisfied as all VIF values were less than 1.2. Based on these statistics, no assumptions were violated, and we proceeded with the regression analysis.

In step 1 of the regression, none of the covariates were significantly associated with self-regulatory efficacy. In step 2, implicit weight bias was significantly related to self-regulatory efficacy (B = .326, p <.001). As the implicit association towards people in larger bodies became more positive (D score increased), so did self-regulatory efficacy and this was a medium effect size. In step 3, internalized weight bias was entered into the regression and was significantly associated with self-regulatory efficacy (B = -.205, p <.05). Implicit weight bias remined significantly associated with self-regulatory efficacy (B = .285, p <.001). As implicit association became more positive (D scores increased), so did self-efficacy and this remained a small to medium effect size. As internalized weight bias decreased, self-efficacy increased, and this was a small effect size. Together, the model accounted for 18.3% of the variance in self-regulatory efficacy. See table 5 for the full regression results.

Table 5. Hierarchical multiple regression results for the prediction of self-regulatory efficacy

Variable	β	Model statistics
DV: Self-regulatory Efficacy		
Step 1:		$F(4,145) = 1.69$, p .154, $r^2 = .045$
MVPA	.138	
Light PA	.049	
Age	.133	
BMI	-.059	
Step 2:		$F(5,144) = 4.94$, $p < .001$, $r^2 = .147$
MVPA	.115	
Light PA	.110	
Age	.127	
BMI	-.043	
Implicit Weight Bias	.326***	
Step 3:		$F(6,143) = 5.35$, $p < .05$, $r^2 = .183$
MVPA	.128	
Light PA	.075	
Age	.085	
BMI	-.002	
Implicit Weight Bias	.285***	
Internalized Weight Bias	-.205*	

Note: *$p < .05$; **$p < .01$; ***$p < .001$; Physical activity = PA; moderate-to-vigorous PA = MVPA.

H3: Internalized weight bias and implicit weight bias will be significantly associated with the tendency to avoid PA.

Prior to conducting the hierarchical regression analysis, statistical assumptions for multiple regressions were checked to ensure there were no violations. There were no multivariate outliers as the Mahalanobis statistic of 21.37 was under the chi square critical value (X^2 = 22.46, *df* = 6) and Cook's distance of .008 was less than 1, meeting this assumption. The assumption of independence of errors was considered met, as the Durbin-Watson statistic of 2.07 was between 1.5 and 2.5. The final tested assumption was multicollinearity, which was also satisfied as all VIF values were less than 1.2. Based on these statistics, no assumptions were violated, and we proceeded with the regression analysis.

In step 1 of the regression, the covariates of age, BMI and MVPA were all significantly associated with the tendency to avoid PA, and all variables had a small to medium effect size (Age B = -.393, p <.001; BMI B = .326, p <.001; Past exercise B = -.219, p <.01). In step 2, implicit weight bias was added to the regression and was significantly associated with the tendency to avoid PA, and this was a small effect size (B = -.148, p <.05). As the implicit association towards people in larger bodies became more negative (D score decreased), the tendency to avoid PA increased. In step 3, internalized weight bias was added to the regression and was significantly associated with the tendency to avoid PA, with a medium to large effect size (B = .453, p <.001). As internalized weight bias increased, so did the tendency to avoid PA. On its own, implicit weight bias was associated with the tendency to avoid PA, however, when internalized weight bias was added to the equation it became non-significant. Together, the model accounted for 47.6% of the variance in predicting the tendency to avoid PA. See table 6 for the full regression results.

Table 6. Hierarchical multiple regression results for predicting the tendency to avoid PA participation.

Variable	β	Model statistics
DV: Tendency to Avoid PA		
Step 1:		$F(4,145) = 13.83$, $p < .001$, $r^2 = .276$
MVPA	-.219**	
Light PA	-.004	
Age	-.393***	
BMI	.326***	
Step 2:		$F(5,144) = 12.18$, $p < .01$, $r^2 = .297$
MVPA	-.209**	
Light PA	-.031	
Age	-.391***	
BMI	.318***	
Implicit Weight Bias	-.148*	
Step 3:		$F(6,143) = 21.68$, $p < .001$, $r^2 = .476$
MVPA	-.237***	
Light PA	.046	
Age	-.298***	
BMI	.228***	
Implicit Weight Bias	-.058	
Internalized Weight Bias	.453***	

Note: *$p < .05$; **$p < .01$; ***$p < .001$; Physical activity = PA; moderate-to-vigorous PA = MVPA.

H4: Internalized weight bias and implicit weight bias will be significantly associated with PA intention.

Prior to conducting the hierarchical regression analysis, statistical assumptions for multiple regressions were checked to ensure there were no violations. There were no multivariate outliers as the Mahalanobis statistic of 5.96 was under the chi square critical value (X^2 = 22.46, *df* = 6) and Cook's distance of .008 was less than 1, meeting this assumption. The assumption of independence of errors was considered met, as the Durbin-Watson statistic of 2.16 was between 1.5 and 2.5. The final tested assumption was multicollinearity, which was also satisfied as all VIF values were less than 1.2. Based on these statistics, no assumptions were violated, and we proceeded with the regression analysis.

In step 1 of the regression, BMI was significant with a medium to large effect size (B = -.159, p <.05), MVPA was significant with a small effect size (B = .456, p <.001) and light PA was also significant with a small effect size (B = .240, p <.001). In step 2, implicit weight bias was added to the regression and was not significantly associated with PA intention. In step 3, internalized weight bias was added to the regression and was not significantly associated with PA intention. Overall, the model accounted for 33.4% of the variance in predicting PA intention. See table 7 for the full regression results.

Table 7. Hierarchical multiple regression results for the prediction of PA intention.

Variable	β	Model statistics
DV: PA Intention		
Step 1:		$F(4,145) = 16.84$, p < .01, $r^2 = .317$
MVPA	.456***	
Light PA	.240***	
Age	-.078	
BMI	- .159*	
Step 2:		$F(5,144) = 14.45$, p .058, $r^2 = .334$
MVPA	.447***	
Light PA	.265***	
Age	-.080	
BMI	-.152*	
Implicit Weight Bias	.132	
Step 3:		$F(6,143) = 11.96$, p .968, $r^2 = .334$
MVPA	.447***	
Light PA	.265***	
Age	-.079	
BMI	-.153*	
Implicit Weight Bias	.133	
Internalized Weight Bias	.003	

Note: *$p < .05$; **$p < .01$; ***$p < .001$; Physical activity = PA; moderate-to-vigorous PA = MVPA.

H5: Internalized and implicit weight bias will be significantly associated with moderate to vigorous PA.

Prior to conducting the hierarchical regression analysis, statistical assumptions for multiple regressions were checked to ensure there were no violations. The Mahalanobis statistic was initially violated (20.39). However, with 1 influential outlier removed, the new Mahalanobis distance was 13.71, which was under the chi square critical value (X^2 = 18.47, df = 4), therefore, it meets the assumption of multivariate outliers. Cook's distance of .007, which was less than 1, also met the assumption of multivariate outliers. The assumption of independence of errors was considered met, as the Durbin-Watson statistic of 2.13 was between 1.5 and 2.5. The final tested assumption was multicollinearity, which was also satisfied as all VIF values were less than 1.2. Based on these statistics, no assumptions were violated, and we proceeded with the regression analysis.

In steps 1, 2 and 3, none of the entered variables were significantly associated with MVPA. The overall model accounted for 0.9% of variance in MVPA. Both implicit and internalized bias were not significantly associated with past MVPA. See table 8 for the full regression results.

Table 8. Hierarchical multiple regression results for the predicting MVPA.

Variable	β	Model statistics
DV: Moderate to Vigorous PA		
Step 1:		$F(2,147) = .436$ p .647, $r^2 = .006$
Age	.068	
BMI	.027	
Step 2:		$F(3,146) = .372$, p .774, $r^2 = .008$
Age	.068	
BMI	.029	
Implicit Weight Bias	.041	
Step 3:		$F(4,145) = .325$, p .861, $r^2 = .009$
Age	.076	
BMI	.022	
Implicit Weight Bias	.047	
Internalized Weight Bias	.038	

Note: *$p < .05$; **$p < .01$; ***$p < .001$; Physical activity = PA; moderate-to-vigorous PA = MVPA.

H6: Internalized weight bias and implicit weight bias will be significantly associated with past light PA.

Prior to conducting the hierarchical regression analysis, statistical assumptions for multiple regressions were checked to ensure there were no violations. The Mahalanobis statistic was initially violated (20.39). However, with 1 influential outlier removed, the new Mahalanobis distance was 13.71, which was under the chi square critical value (X^2 = 18.47, df = 4), therefore, it met the assumption of no multivariate outliers. Cook's distance of .007, which was less than 1, also met the assumption of multivariate outliers. The assumption of independence of errors was considered met, as the Durbin-Watson statistic of 2.1 was between 1.5 and 2.5. The final tested assumption was multicollinearity, which was also satisfied as all VIF values were less than 1.2. Based on these statistics, no assumptions were violated, and we proceeded with the regression analysis.

None of the covariates were significant in step 1. In step 2, implicit weight bias was significantly associated with light PA and had a small effect size (B = -.175, p <.05). Contrary to the hypothesized direction, as the implicit association towards people in larger bodies became more negative (D score decreased), light PA increased. Finally, in step 3, implicit weight bias remained significant, maintaining a small effect size (B = -.203, p <.05). Internalized weight bias was added to the regression and was also significantly associated with light PA, with a small effect size (B = -.172, p <.05). As hypothesized, as internalized weight bias decreased, past light PA increased. Overall, the model accounted for 6.5% of variance in light PA. See table 9 for the full regression results.

Table 9. Hierarchical multiple regression results for predicting light PA.

Variable	β	Model statistics
DV: Light PA		
Step 1:		$F(2,147) = .583$ p .647, $r^2 = .008$
Age	.046	
BMI	.069	
Step 2:		$F(3,146) = 1.934$, $p < .05$, $r^2 = .038$
Age	.048	
BMI	.058	
Implicit Weight Bias	-.175*	
Step 3:		$F(4,145) = 2.509$, $p < .05$, $r^2 = .065$
Age	.012	
BMI	.091	
Implicit Weight Bias	-.203*	
Internalized Weight Bias	-.172*	

Note: *$p < .05$; **$p < .01$; ***$p < .001$; Physical activity = PA; moderate-to-vigorous PA = MVPA.

Discussion

The current study used a dual process perspective to examine implicit and internalized weight bias as predictors of the expectation of experiencing weight stigma, the tendency to avoid PA, self-regulatory efficacy, PA intention, past MVPA and past light PA. Previous research has separately examined both implicit weight bias and internalized weight bias in association with other anti-fat health behaviours (Bevan et al., 2021; Major et al., 2020; Nutter et al., 2023). However, to my knowledge, this was the first study to examine both implicit and internalized weight bias together to understand PA engagement. As well, this was the first study to demonstrate an association between implicit weight bias and different cognitions like the expectation of experiencing weight stigma, self-regulatory efficacy and the tendency to avoid PA. Below, each key finding is discussed, while highlighting the contributions to literature. Following this, theoretical and practical implications are discussed, and study strengths, limitations and future directions are also discussed.

People in larger bodies regularly experience weight stigma in exercise and PA settings (Nutter et al., 2023) and previous research has indicated that people in larger bodies often cope with this through self-exclusion (Gumble & Carels, 2012; Bevan et al., 2021). The expectation of experiencing weight stigma may deter public PA participation. In order to promote PA among people in larger bodies, they first need to feel safe and included within public PA and exercise settings (Bevan et al., 2021; Myre et al., 2022). Expected weight stigma may deter PA and is therefore an important factor to consider when developing PA promotion strategies, especially for people in larger bodies.

Hypotheses

According to Hypothesis 1, implicit and internalized weight bias would both be significantly associated with and account for a significant proportion of variance in the

expectation of experiencing weight related stigma, beyond the contribution of BMI, age and other covariates. This hypothesis was supported. As the implicit association became more negative (suggesting greater negative implicit bias), expected weight stigma increased and as internalized weight bias increased, expected weight stigma also increased. On its own, implicit weight bias was associated with expected weight stigma, however, when internalized weight bias was added to the equation it became non-significant. Together, the model accounted for a large proportion of the variance in the expectation of experiencing weight stigma.

To the best of my knowledge, this was the first study to examine the association between implicit weight bias and the expectation of experiencing weight stigma. The positive association between internalized weight bias and expected weight stigma supports previous literature (Bevan et al., 2022; Thedinga et al., 2021; Hunger et al., 2020). For example, Thedinga et al. (2021) found that people in larger bodies who experienced overt discrimination in PA spaces internalized these experiences and tended to avoid participating in PA because of the fear of being stigmatized. Experiencing stigma by others may lead an individual to see themself in stigmatising terms, therefore internalizing the negative beliefs. Previous research has also suggested that having internalized weight stigma may make an individual more likely to exclude themselves from a potentially stigmatizing situation, like a public gym or community rec center (Myre et al., 2021; Thedinga et al., 2021). Expecting stigma when attempting to be active could be a consequence of internalizing stigma from others and may be one psychological factor that dissuades PA for people in larger bodies.

Implicit measures typically have a weaker association to social cognitive and behavioural variables than explicit measures (Meissner, 2019). This could help explain why implicit weight bias became non-significant once internalized weight bias was added into the equation. These

findings may also suggest that between implicitly- and explicitly assessed weight bias, it may be explicit cognitions driving outcome expectations. As such, propositional beliefs maybe a stronger determinant of outcome expectations, than associative processes. The findings suggest that both implicitly and explicitly measured weight bias may be important, albeit explicitly measured weight bias may be the stronger factor, in understanding whether people in larger bodies expect to experience stigma when they are active.

Hypothesis 2 was that implicit and internalized weight bias would be significantly associated with and account for a significant proportion of the variance in self-regulatory efficacy, beyond the contribution of covariates. This hypothesis was supported. As the implicit association towards people in larger bodies became more positive (suggesting a more positive implicit bias), self-regulatory efficacy increased. Implicit weight bias remained significant and internalized weight bias was also significantly associated with self-regulatory efficacy. As internalized weight bias decreased, self-efficacy increased. Together, the model accounted for a moderate proportion of the variance in self-regulatory efficacy. These findings suggest that individuals with a greater negative bias towards people in larger bodies report lower self-efficacy. This is a novel finding, as, to the best of my knowledge, this is the first study to examine the association between implicit weight bias and self-efficacy. These findings also support previous literature, suggesting that experiences of weight stigma and internalized weight bias are associated with lower self-efficacy (Thedinga et al., 2021). People in larger bodies may expect to be discriminated against in PA spaces because of their past experiences or because of the weight-based discrimination they have see in the media. When stigma is internalized, it may have a detrimental impact on one's confidence to self-regulate their thoughts and emotion to be active, which might work to discourage PA participation (Thedinga et al., 2021; Meadows and

Bomback, 2018; Losekam et al., 2010). Internalized weight bias and reduced self-efficacy have been shown to be related to health-promoting behaviours, like PA (Foster et al., 2024). In terms of the dual process model, these findings suggest that both associative and propositional processes may be important in predicting self-efficacy. Both may function as sources of information that people in larger bodies use to form their own self-efficacy beliefs. An in-depth explanation is continued in the theoretical implications section.

Hypothesis 3 examined whether implicit and internalized weight bias were associated with the tendency to avoid PA, beyond the covariates. This hypothesis was supported. Implicit weight bias was significantly associated with the tendency to avoid PA. As the implicit association towards people in larger bodies decreased (suggesting a more negative implicit bias), the tendency to avoid PA increased. This is a novel finding, as, to the best of my knowledge, this is the first study to examine the association between implicit weight bias and the tendency to avoid PA. Internalized weight bias was also significantly associated with the tendency to avoid PA. As internalized weight bias increased, so did the tendency to avoid PA. On its own, implicit weight bias was associated with the tendency to avoid PA, however, when internalized weight bias was added to the equation it became non-significant. Together, the model accounted for a large proportion the variance in the tendency to avoid PA.

According to the Associative-Propositional dual process model (Conroy & Berry, 2017) and Affective Reflective Theory (Brand & Ekkekakis, 2021), associative processes are often directly related to behaviours, like PA, albeit with typically with small effects (Chevance et al., 2019). Propositional beliefs in the form of explicitly measured cognitions are suggested to be stronger predictors of other propositional beliefs, like the tendency to avoid PA. Experiences of weight stigma often lead individuals to internalize the stigma, which in turn, is associated with a

greater tendency to avoid PA (Foster et al., 2024). Psychosocial factors such as internalized weight bias play a central role in the desire to want to be active. Vartanian and Novak (2011) examined internalized weight bias as a moderator of the association between weight stigma and avoidance of exercise. The study found that the relationship between weight stigma and avoiding PA was moderated by internalized weight bias, such that greater internalized weight bias led to a greater tendency to avoid PA. Similar to Vartanian and Novak's (2011) findings, it could also be that implicit and internalized weight bias interact with other variables to predict PA avoidance.

The tendency to avoid PA has been shown to be related to PA for women in larger bodies (Bevan et al., 2022). These findings are consistent with weight bias, body image and eating disorder literature showing that women are more affected by weight and size related concerns, as women are more likely to be exposed to weight stigma (Jayawickrama et al., 2023; Thedinga et al, 2021). Experiences of weight stigma can directly lead to internalized weight bias and the expectation of experiencing weight stigma. In order to avoid discrimination, people in larger bodies may exclude themselves from public PA settings (Thedinga et al, 2021), choosing not to be active or to be active on their own in more private setting. The current study also found that the tendency to avoid PA was correlated with past MVPA but not past light PA. The lack of relationship between the tendency to avoid PA and past light PA may suggest that people in larger bodies may not be trying to avoid light PA the same way they would avoid MVPA. Light PA can more easily be performed more independently or at home rather than a public PA setting. It could be that light PA draws less attention to the self compared to more intense forms of PA and is not avoided in the same way as MVPA is. Additionally, light PA may not be subject to the same level of stigma, as light PA is seen as more appropriate for people in larger bodies (Myre et al., 2021; Myre et al., 2022).

Hypothesis 4 and 5 examined whether implicit and internalized weight bias were associated with PA intention and MVPA. Neither hypothesis was supported, as both implicit and internalized weight bias were not significantly associated with the two outcomes. These findings are partly supported by pre-existing literature, as Muschalik et al. (2018) found that implicit attitudes of PA did not have a direct effect on PA intention or past MVPA. Although there was no direct relationship between implicit attitudes and PA intention or MVPA, implicit attitudes have been shown to moderate the relationship between self-efficacy and PA intention and PA behaviour (Muschalik et al., 2018). These findings could suggest that on their own, implicit attitudes may not predict PA intention or past MVPA but may rather function as a moderating or mediating variable.

MVPA refers to participating in moderate to high intensity exercise, such as working out at a gym, playing sports or participating in structured, repetitive movements at an elevated intensity. Engaging in MVPA, especially in public exercise settings, has the potential to be distressing for people in larger bodies. Current body image ideals in media often portray thin bodies participating in MVPA and this possible lack of representation may lead people in larger bodies to feel like they cannot participate in MVPA (Myre et al., 2022; Meadows & Bomback, 2018). This could promote and exacerbate internalized weight bias, which then works to dissuade PA participation for people in larger bodies. Existing literature has shown a significant association between internalized weight bias and exercise avoidance (Vartanian & Novak, 2011; Bevan et al., 2021; Gumble & Carels, 2012; Thedinga et al., 2021). The current study also found that MVPA was significantly correlated with the tendency to avoid PA. It could be that internalized weight bias acts as a moderator of the relationship between PA avoidance and MVPA.

Hypothesis 6 examined whether implicit and internalized weight bias were associated with light PA. This hypothesis was partially supported. Implicit weight bias was significantly associated with past light PA and remained significant when internalized weight bias was added into the equation. However, contrary to the hypothesis, as implicit weight bias decreased (suggesting a more negative implicit bias), light PA increased. Hinman et al. (2015) found that individuals with a more negative implicit bias towards people in larger bodies had greater beliefs about the controllability of weight. A person living in larger body may perceive their body weight and size as modifiable and their implicit biases could serve as a motivation to lose weight (Carels et al., 2014). Alternatively, it could be that implicit weight bias prompts thoughts about light activity whereby women in larger bodies are more likely to select light PA over MVPA, in an effort to avoid being in public PA spaces where they may feel stigmatized.

Internalized weight bias was also significantly associated with past light PA. In line with the hypothesis, as internalized weight bias decreased, past light PA increased. Overall, the model accounted for a small proportion of the variance in light PA. Light PA refers to low intensity activities such as walking and other acts of daily living, such as cleaning, gardening, etc. According to previous research, participating in light PA maybe less stressful for people in larger bodies, as it can be more private and does not require being active in public fitness spaces, like gyms or studios, where the chance of stigma or discrimination may be higher (Myre et al., 2021). Overall, the findings suggest that implicitly- and explicitly assessed weight bias are related to light PA but not MVPA.

Theoretical implications

Dual process approaches suggest that biases can occur at both the associative and propositional level (Brand & Ekkekakis, 2018). This study applied a dual process framework to

assess implicit weight bias as part of the associative system, and internalized weight bias as a part of the propositional system. Between the two processes, implicit weight bias was significantly associated with self-regulatory efficacy and past light PA, above and beyond the propositional measure of internalized weight bias which was consistently associated with the measured outcomes. This indicates that weight bias at both the associative and propositional level may be important in deciding whether to be active. Stimuli towards PA may automatically trigger negative implicit weight bias which subsequently activates other mental associations about PA (Presseau et al., 2014; Conroy & Berry, 2017). These mental associations, like internalized weight bias, may then be used in the process of propositional validation, as the individual decides whether to participate in light PA. It could be that PA for people in larger bodies, the thought of PA is most strongly connected to light PA, rather than more intense types, such as MVPA.

Women in larger bodies are generally excluded from media content depicting intense exercise and the absence of positive representation as a source of social persuasion could contribute to a lack of self-efficacy (Ross, 2022). This furthers the stigmatization of people in larger bodies, especially within PA promotion contexts which takes a weight-centric approach that views fatness as self-inflicted (Myre et al., 2022). People in larger bodies are often told that they need to participate in PA in order to achieve a thin and socially desired body size (Myre et al., 2021; Major et al., 2020). However, people in larger bodies are stigmatized while they are in PA spaces (Myre et al., 2022; Ross, 2022). This paradox may suggest a reason why people in larger bodies with stronger negative implicit bias have a stronger preference for light PA, as it tends to be more independent (Thedinga et al., 2021).

Internalized weight bias was also negatively associated with light PA, while implicit weight bias was positively associated. This could suggest that the initial thought content associated with implicit weight bias evokes light PA within their propositional statements about exercise. During the process of propositional validation, individuals may recall past experiences of weight stigma. These thoughts have the potential to disrupt the initial impulse to be active. According to the Affective-Reflective Theory of physical inactivity and exercise (Brand & Ekkekakis, 2017) when the propositional evaluation implied by the affective gut response is inconsistent with other relevant propositional beliefs, the inconsistency must be resolved to avoid aversive feelings resulting from cognitive dissonance. When implicit and explicit processes seem to be operating in an opposite direction, it may indicate that cognitive dissonance occurs when people in larger bodies think about doing PA.

Contrarily, implicit weight bias was initially significant in predicting the expectation of experiencing weight stigma and the tendency to avoid PA, but this relationship became non-significant, once internalized weight bias was added in. Often propositional beliefs are more strongly associated with one another than with implicit evaluations (Haeffel et al., 2007). Implicit evaluations may be initially involved in evoking outcome expectations and avoidance beliefs, but the extent to which weight bias is internalized as explicit statements may be more important in forming and sustaining these beliefs. For example, the stored mental associations to PA (indicative of internalized weight bias) are stronger than the initial affective gut reaction (indicative of implicit weight bias). This is a novel finding, as to my knowledge, this is the fist study to examine implicit attitudes towards people in larger bodies as a predictor of the tendency to avoid PA.

Social Cognitive Theory suggests that there are two main individual-level factors that influence behaviour: outcome expectations and self-efficacy (Bandura, 1997). Theoretically, this study examined implicit and internalized weight bias as potential sources of information for forming beliefs. We found that implicit weight bias might be an initial source of information, however, it may be overridden when internalized weight bias is considered alongside it. These associations could suggest that women in larger bodies draw on implicit and explicit evaluation of weight bias when forming expectations about whether they think they will experience stigma when being active. Bandura (1997) described three types of outcome expectations: physical, social and self-evaluative. It is possible that internalized weight bias perceptions are used when forming self-evaluative and social outcome expectations. Internalized weight bias includes negative self-beliefs that people in larger bodies may draw on when thinking about whether they expect to experience judgements in a PA space. The stronger the internalized weight bias, the more likely women in larger bodies would be to expect to have negative self-evaluations when active. Past experiences of stigma that have led to the internalization of weight bias may also be drawn upon when women in larger bodies think about whether they expect to be stigmatized in a PA setting. The stronger the internalized weight bias, the more likely that social evaluations would be negative. In these ways, negative internalized weight perceptions may result in negative outcome expectations when being active.

Bandura suggests four different sources of self-efficacy that individuals draw on to from their self-efficacy beliefs: mastery experiences, vicarious experiences, social persuasion, and physiological and emotional states (Bandura, 1997). Internalized weight bias and resulting perceptions could represent some of these sources of information. For example, vicarious experiences include seeing other people with whom you can identify, engaging and succeeding at

a task (Bandura, 1986). Meadows and Bomback (2019) suggest that the erasure of positive representations of people in larger bodies being physically active may have a negative impact on self-efficacy. For people in larger bodies, the lack of representation and negative stereotypes about exercise and fatness as being incompatible could represent a visual source of vicarious experience that lowers self-efficacy for women in larger bodies. Another source of self-efficacy is social persuasion; for people in larger bodies this can include hearing and internalizing negative messaging about their size or assumed inability to be active can be a source of information that lowers self-efficacy. Psychological and emotional states are also a source of self-efficacy. Internalized weight bias may have negative affective components, where individuals with high internalized weight bias may also struggle with other mental health concerns, poor body image and self-esteem concerns (Nutter et al., 2023; Durso and Latner, 2008). As such the negative feelings associated with internalized weight bias may negatively impact their self-efficacy and their confidence to be active.

This study examined implicit and internalized weight bias as sources of information for forming self-efficacy beliefs and found that both the associative and propositional system may represent sources of information women in larger bodies used to form self-regulatory beliefs. A limitation of previous literature is that it has either examined implicit and internalized weight bias separately or it has measured implicit weight bias alongside social perceptions of weight stigma (not internalized). Using a dual process approach allowed us to better examine whether explicitly- or implicitly assessed internalized weight bias was related to different weight-related cognitions and behaviour. These findings are consistent with social cognitive theory, as the propositional system was a stronger predictor of outcome expectations. However, these findings

also support the existing literature by suggesting that for forming self-efficacy beliefs, both the implicit and explicit cognitions are important.

Practical implications

For many people living in larger bodies, PA cues may automatically trigger negative associations of weight bias, and these automatic negative associations may work to discourage PA participation. Women in larger bodies are often teased, shamed, and humiliated by other exercisers due to their excess weight (Myre et al., 2020). Individuals in smaller bodies, who perpetuate weight stigma may feel like they are on 'safe moral ground' because fatness is viewed as self-inflicted, a result of laziness and lack of will-power that necessarily leads to poor health (Puhl & Brownell, 2003). Current weight-centric views have often prioritised thinness over wellbeing and current fitness and health promotion strategies center around portraying thin women as "fit" and "healthy" (Myre et al., 2021; Meadows & Bombak, 2019). Individuals may eventually begin endorsing these beliefs about weight, PA and health, demonstrating how women in larger bodies have come to internalize the weight bias they experience. Women in larger bodies are often told to participate in PA as a way to make themselves smaller and this has a contradictory impact on how women in larger bodies come to engage in PA. Both implicit and internalized weight bias can result in a greater expectation of experiencing stigma. Due to this heightened anticipation of experiencing weight stigma, women in larger bodies can turn to protective strategies such as avoiding certain types of PA to minimize future distress. The broader impact of this may make women in larger bodies view PA as a lose-lose situation. On one hand, women in larger bodies are encouraged to be physically active to lose weight; on the other hand, experiencing weight stigma in public PA spaces may lead them to feel judged and unwelcome, making it difficult for women in larger bodies to foster a positive relationship with PA.

Women in larger bodies may face structural weight stigma, such as being excluded from using some exercise equipment due to weight limits (i.e., some treadmills have a maximum weight limit of 250-300 lbs) having difficulty finding exercise clothing in their size, and being portrayed negatively in anti-fat PA advertising and health promotion strategies (Myre et al., 2021; Scott-Dixon, 2008). This acts to further separate women based on body size and serves a reminder that women in larger bodies may not always be welcome in public PA spaces. The current study findings align with these observations, by demonstrating that weight stigma, which comes from the social environment, can be internalized at the associative and propositional levels with potential negative outcomes like expecting to experience weight stigma at the gym, low self-regulatory efficacy to manage thoughts and emotions to be active and an increased tendency to avoid PA. Given the harmful consequences of weight-centric and weight-stigmatizing PA, different approaches to PA promotion and practice are needed (Myre et al., 2021). Size inclusion offers an alternative to weight-centric approaches to PA. Often taking a social justice stance, proponents of size inclusion aim to reduce weight stigma, celebrate diverse body shapes and sizes, and endorse positive representations of people with larger bodies (Myre et al., 2021; Scott-Dixon, 2008; Ross, 2022). A related concept is weight neutrality, where focus is moved away from weight and weight loss. This research meant to inform health and fitness professionals, that in order to reduce weight stigma and encourage PA participation for people in larger bodies, a weight-neutral approach must be adopted (i.e., focusing conversations about exercise around functional, social, emotional and mental health benefits; having different ways of measuring progress outside of weight, BMI or body fat %; Dugmore et al., 2019). Another example of taking a weight neutral approach could be to hire exercise professionals that also live in larger bodies. Drawing on principles from the Health At Every Size (HAES) approach, weight-neutral PA focuses on health irrespective of body size (Myer et al., 2021; Ross 2021;

Myer et al., 2022). It recognises that the factors affecting body weight are numerous and complex, that health goes beyond physical health to include emotional, social, and mental health, and that weight loss should not be the primary reason to participate in PA (Meadows & Bomback, 2019; Myer et al., 2021; Ross 2021; Myer et al., 2022). Public PA spaces, such as fitness facilities would benefit from adopting this weight neutral health promotion approach if they want to encourage people in larger bodies to be physically active. Individuals with strong internalized weight bias may need clear anti-stigmatizing messaging in order for them to feel safe and comfortable being active in fitness facilities.

Study Strengths, Limitations & Future Direction

This was a novel study, as implicit weight bias and internalized weight bias have not been examined together in the existing literature. This study had several strengths; firstly, all study participants self-identified as women living in larger bodies and this population is currently under-researched. This study may provide some insight into how women in larger bodies limit their PA interactions because of implicit and internalized weight bias. This may be an important consideration for future health promotion strategies, as using a more weight-neutral approach maybe more effective in encouraging PA participation. Another strength of this study is that the study design was based on dual process models and social cognitive theory. Rooting this research in theory allowed for the formation of clear, theory-informed hypotheses. Finally, variables previously shown to impact PA participation for people in larger bodies were controlled for in the analysis as covariates.

In terms of limitations, study findings may only be generalizable to participants self-identified as women, with a BMI over 25 and self-identified as living in larger body. Current literature suggests that men may experience and internalize weight bias differently, as a result,

we might observe different relationships in a sample of men (Sattler et al., 2018). Additionally, a majority of the participants were Caucasian. Findings might not generalize to individuals belonging to other marginalized ethnicities, where there may be cultural differences in weight norms and stigma (Himmelstein et al., 2017). The homogeneous sample is useful for understanding weight bias experiences relevant to this particular group, however, it limits the ability to generalize these findings for other individuals with differing genders, ethnicity and/or body size.

All study participants were recruited through an online platform, and it is possible that those who self-selected to be part of the study maybe more motivated to participate in research about PA and therefore their responses may not generalize for broader populations. However, we weighed this against the benefit of conducting a study that was able to reach participants across Canada, rather than a single region.

Another limitation of this research was that the sample size may not have been large enough to detect all significant effects. The original power calculation was based on running the regression analysis without covariates. After conducting the study and reviewing additional literature, PA and demographics were added as covariates which may have reduced statistical power. Despite this, many of the hypotheses were still supported.

Additionally, research suggests that the reliability and validity of the weight bias internalization scale is improved by removing the first item (Hilbert et al., 2014). However, this study used the original weight bias internalization questionnaire and did not remove the first question, which may have impacted the reliability of the measure. Future research should consider removing the one item from the scale as it may reduce measurement error in future analyses.

IATs are influenced by context and the scores could have been influenced by what the participant was exposed to right before they took the IAT (Meissner et al., 2019). What a person most recently encountered will more be salient and readily come to mind, and thus captured in the IAT. It was not possible to ensure the reliable completion of the IAT and the study design did not account for potential misunderstandings or distractions in the participant's environment. However, it should be noted that the IAT has response time thresholds to ensure internal validity. The software will not produce a score if participants fail to complete it properly, which gives us some confidence in the validity of the D scores.

Another limitation was the use of a self-reported PA measure, which has been shown to overestimate PA levels (Colley et al., 2018). Future studies could use an objective measure of PA, such as an accelerometer, along with implicit measures for a more accurate measure of PA. Future studies should replicate the study design but include participants with varying gender identities, varying ethnicities and varying body sizes, in order to increase the generalizability of the findings. Future research could examine whether implicit and internalized weight bias are modifiable, and whether this increases PA for people with larger bodies. Researchers should continue to examine weight stigma with the objective of promoting size inclusive PA settings. Promoting self-compassion may serve as an individual-led approach to improving size inclusion among those living in larger bodies. Researchers could also examine public PA settings to identify factors that contribute towards weight bias in these spaces, with the goal of encouraging more weight neutral PA environments (Myre et al., 2022; Lamont & Deines, 2023; Puhl et al., 2020).

Conclusion

This study used a dual process model to examine implicit and internalized weight bias as predictors of the expectation of experiencing weight stigma, the tendency to avoid PA, fear of appearance evaluation, self-regulatory efficacy, PA intention, past MVPA and past light PA. The study found that both implicit and internalized weight bias were significantly associated with the tendency to avoid PA, fear of appearance evaluation, self-regulatory efficacy and past light PA. To my knowledge, this is the first study to examine both implicit and internalized weight bias as predictors for PA participation, outcome expectations and self-regulatory efficacy. Future research should continue to examine barriers to and factors that influence PA participation for women in larger bodies.

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Appendix 1: Ethics Certificate

Brock University
Office of Research Ethics
Tel: 905-688-5550 ext. 3035
Email: reb@brocku.ca

Health Science Research Ethics Board

Certificate of Ethics Clearance for Human Participant Research

DATE: 1/25/2024

PRINCIPAL INVESTIGATOR: LOCKE, Sean - Kinesiology

FILE: 23-185 - LOCKE

TYPE: Masters Thesis/Project STUDENT: Jesica Jabbar
SUPERVISOR: Sean Locke

TITLE: Examining the effects of implicit and internalized weight bias on physical activity participation for women in larger bodies

ETHICS CLEARANCE GRANTED

Type of Clearance: NEW Expiry Date: 1/1/2025

The Brock University Health Science Research Ethics Board has reviewed the above named research proposal and considers the procedures, as described by the applicant, to conform to the University's ethical standards and the Tri-Council Policy Statement. Clearance granted from **1/25/2024** to **1/1/2025**.

The Tri-Council Policy Statement requires that ongoing research be monitored by, at a minimum, an annual report. Should your project extend beyond the expiry date, you are required to submit a Renewal form before 1/1/2025. Continued clearance is contingent on timely submission of reports.

To comply with the Tri-Council Policy Statement, you must also submit a final report upon completion of your project. All report forms can be found on the Office of Research Ethics web page at https://brocku.ca/research-at-brock/office-of-research-services/research-ethics-office/#application-forms

In addition, throughout your research, you must report promptly to the REB:

a) Changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) All adverse and/or unanticipated experiences or events that may have real or potential unfavourable implications for participants;
c) New information that may adversely affect the safety of the participants or the conduct of the study;
d) Any changes in your source of funding or new funding to a previously unfunded project.

We wish you success with your research.

Approved:

Stephen Cheung, Chair
Health Science Research Ethics Board

Note: Brock University is accountable for the research carried out in its own jurisdiction or under its auspices and may refuse certain research even though the REB has found it ethically acceptable.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and clearance of those facilities or institutions are obtained and filed with the REB prior to the initiation of research at that site.

Appendix 2: Study measures

Godin Leisure Time Exercise Questionnaire:

During a typical 7-Day period (a week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time (write on each line the appropriate number).

Type of exercise	Times per week
STRENUOUS EXERCISE (heart beats rapidly) (e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling)	
MODERATE EXERCISE (not exhausting) (e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)	
MILD/LIGHT EXERCISE (minimal effort) (e.g., yoga, archery, fishing from riverbank, bowling, golf, easy walking)	

PA Intention Questionnaire:

1. On how many days in the next week do you plan to do structured PA?

General self-efficacy scale:

Please rate how applicable these statements are to you personally, on a 4 point scale. (1 = "not true at all true" to 4 = "exactly true"

1. I can always manage to solve difficult problems if I try hard enough.
2. If someone opposes me, I can find the means and ways to get what I want.
3. It is easy for me to stick to my aims and accomplish my goals.
4. I am confident that I could deal efficiently with unexpected events.
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.
6. I can solve most problems if I invest the necessary effort.
7. I can remain calm when facing difficulties because I can rely on my coping abilities.
8. When I am confronted with a problem, I can usually find several solutions.
9. If I'm in trouble, I can usually think of a solution.
10. I can usually handle whatever comes my way.

Fear of Appearance Evaluation Scale:

Please rate how applicable these statements are to you personally, on a 5 point scale. (1 = "Not at all" to 5 "extremely true"

1. I am concerned about what other people think of my appearance.
2. It bothers me if I know someone is judging my physical shape.
3. I worry that people will find fault with the way I look.

4. When I meet new people, I wonder what they think about my appearance.
5. I am afraid other people will notice my physical flaws.
6. I think that other people's opinions of my appearance are too important to me.

The tendency to avoid PA and sport scale:
Please rate how much you agree with these statements are to you personally, on a 5 point scale. (1 = Strongly disagree to 5 = strongly agree).

1. I find myself avoiding participating in sport because of my weight.
2. I avoid participating in sport because of my fear of being judged about my lack of physical ability.
3. I worry about participating in sport because I don't like how my body looks when playing sports.
4. I am afraid other people will notice my physical flaws when I participate in sport.
5. I am concerned about what other people think of my appearance when I participate in sport.
6. I Avoid PA because I might get teased about my weight.
7. I avoid PA because of my fear of being judged about my physical appearance.
8. I avoid PA because I worry that people may make negative comments about my body.
9. I avoid PA because I worry that people may make negative comments about my body.
10. I would prefer to participate in PA in a more private setting.

Weight Implicit Association Task: using the Inquisit software from the Millisecond Software company.

Weight bias internalization scale:
Please indicate the extent to which you agree with the following statements about yourself, using a 7-point scale (1 = "strongly disagree" and 7 = "strongly agree").

1. As an overweight person, I feel that I am just as competent as anyone.
2. I am less attractive than most other people because of my weight.
3. I feel anxious about bring overweight because of what other people might think of me.
4. I wish I could drastically change my weight.
5. Whenever I think a lot about being overweight, I feel depressed.
6. I hate myself for being overweight.
7. My weight is a major way that I judge my value as a person.
8. I don't feel that I deserve to have a really fulfilling social life, as long as I'm overweight.
9. I am OK being the weight that I am.
10. Because I'm overweight, I don't feel like my true self.
11. Because of my weight, I don't understand how anyone attractive would want to date me.